

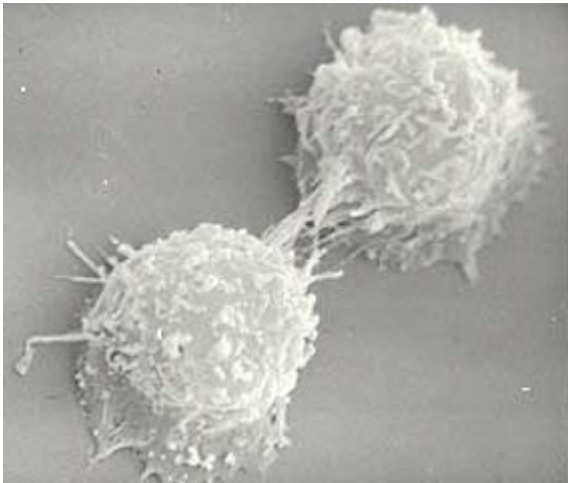
AS Unit 1: Basic Biochemistry and Cell Organisation

Name:	Date:
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Topic 1.6 Cell Division – Page 3

I. Mitosis

		Completed
1.	Read and complete Hand out 1.7I Further Notes on Cell Division	
2.	Complete the cell division crossword	
3.	Revise for a 1.7 mini test next lesson	



Why is mitosis so important?

1. **In growth** - builds a multi-cellular body from a zygote or spore (first cell). Because mitosis produces daughter nuclei with chromosomes identical in number and type, this means that all body (somatic) cells will have identical nuclei each with an exact copy of the original 'set' of chromosomes. (Different cell types are achieved by 'switching off different parts of the DNA code - these genes remain coiled as heterochromatin).
2. **In cell repair and replacement** - worn out or lost cells are replaced by division of adjacent cells, e.g. germinal layer of skin epidermis.
3. **In reproduction** - the production of new individuals involves the transfer of genetic information from parent to offspring. There are two types of reproduction.
 - a) **Sexual reproduction** involves the production of special cells, haploid male and female gametes, which on fusion form a zygote. This brings together the genetic information from parents and ensures it is passed on to offspring.
 - b) **Asexual reproduction** (cloning) of some plants and simple animals, fungi and bacteria involves mitotic cell division which produces offspring with the same inherited genetic information identical to that of the single parent from which they formed by fission (splitting) as spores or multi-cellular bodies.

The Cell cycle

* the cell cycle is the sequence of events that occurs from the formation of an individual cell until it divides to form daughter cells.

It is usual to divide the cycle into **three stages**:

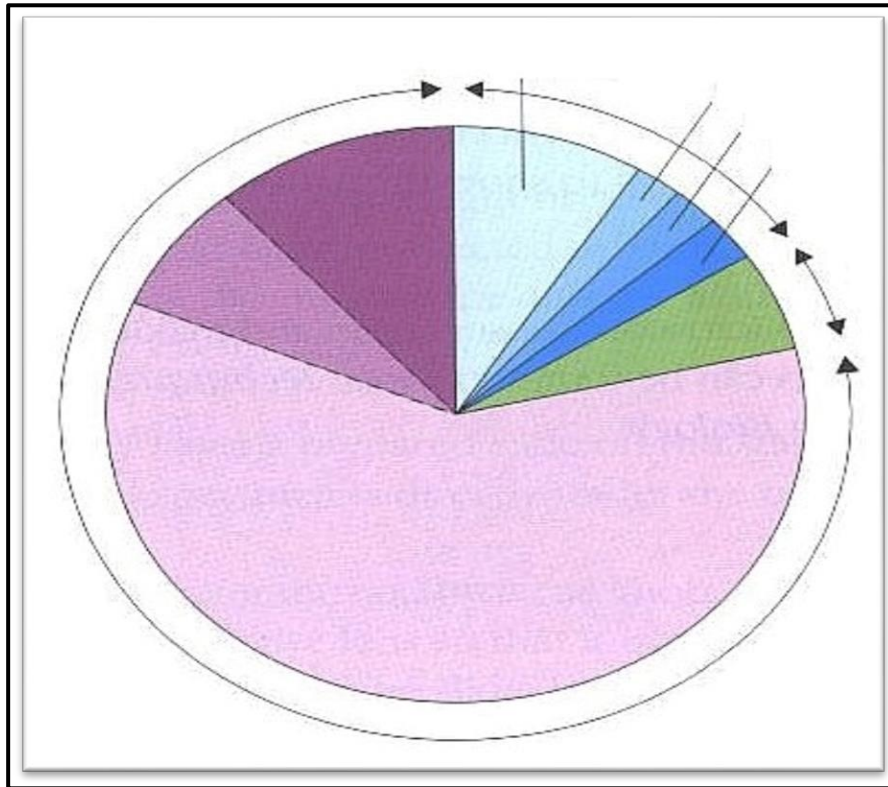
1. **Interphase**
2. Nuclear division—**mitosis** or **meiosis**
3. Division of the cytoplasm—**cytokinesis**

Interphase is sometimes called the resting stage and this implies that nothing happens during this stage of the cell cycle. **This is not true!**

Summary of what you need to know!

* As you will see from the diagram on the next page, the process of nuclear division (mitosis or meiosis) occupies only a small percentage of the cell cycle. The remaining percentage is used for the copying and checking of the genetic information.

Annotate this diagram using the text book page 61- 62 and the PowerPoint

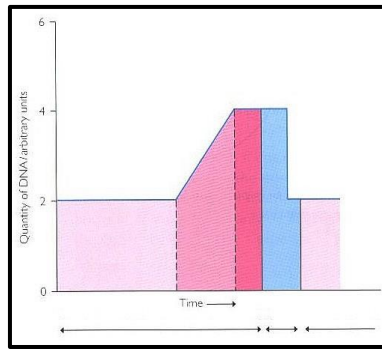


Chromosome number * The number of chromosomes present in the somatic or body cells of an individual organism is usually constant and will be the same for all individuals of that species. As there are two identical sets of chromosomes in each cell, the chromosome number is said to be **diploid**. It is written as $2n$, so for the onion the diploid number $2n = 16$, for the tomato $2n = 24$ and for the human $2n = 46$.

* It follows that the gametes will normally contain only one set of each pair of chromosomes, that is a single set. Gametes are therefore described as being **haploid** and the number is written as n . In onion gametes, $n = 8$, in the tomato $n = 12$ and in humans $n = 23$.

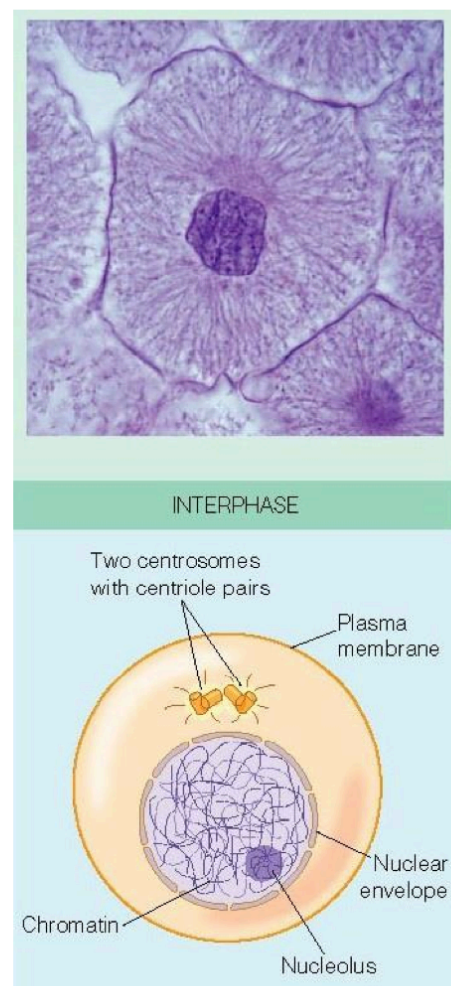
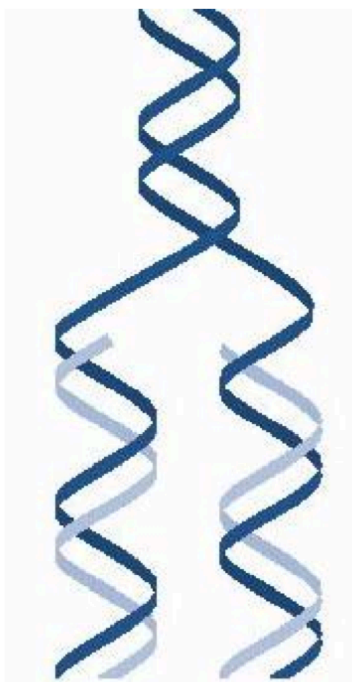
* For an organism to grow and replace damaged cells it must be able to produce new cells that are identical to the original cell. It does this by **mitosis or mitotic nuclear division**.

If an original parent cell containing the $2n$ amount of DNA produces two identical daughter cells they must also contain the $2n$ quantity of DNA. This means that the DNA content of the cell must be duplicated/replicated and then divided equally amongst the two daughter cells. Cells that are produced by mitosis are sometimes called **clones** because they are genetically identical to the parent cell. In certain organisms, mitosis is used as a form of reproduction.



Interphase (occurs prior to mitosis)

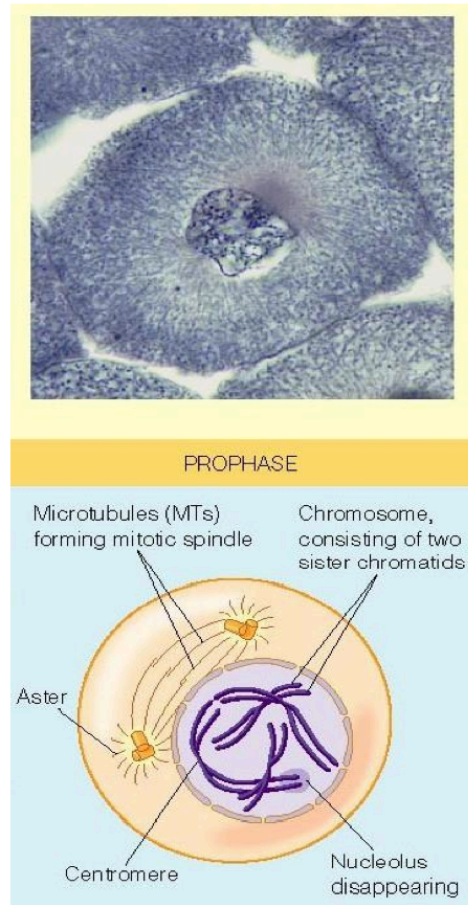
The cell has the normal appearance of a non-dividing cell. The nucleus appears inactive but it is during this stage that the DNA is replicated. (S phase)



Chromosomes begin to appear but are thread-like and indistinct. In animal cells the **centrioles** have also replicated and are visible. (Remember, centrioles are not present in the vast majority of plant cells)

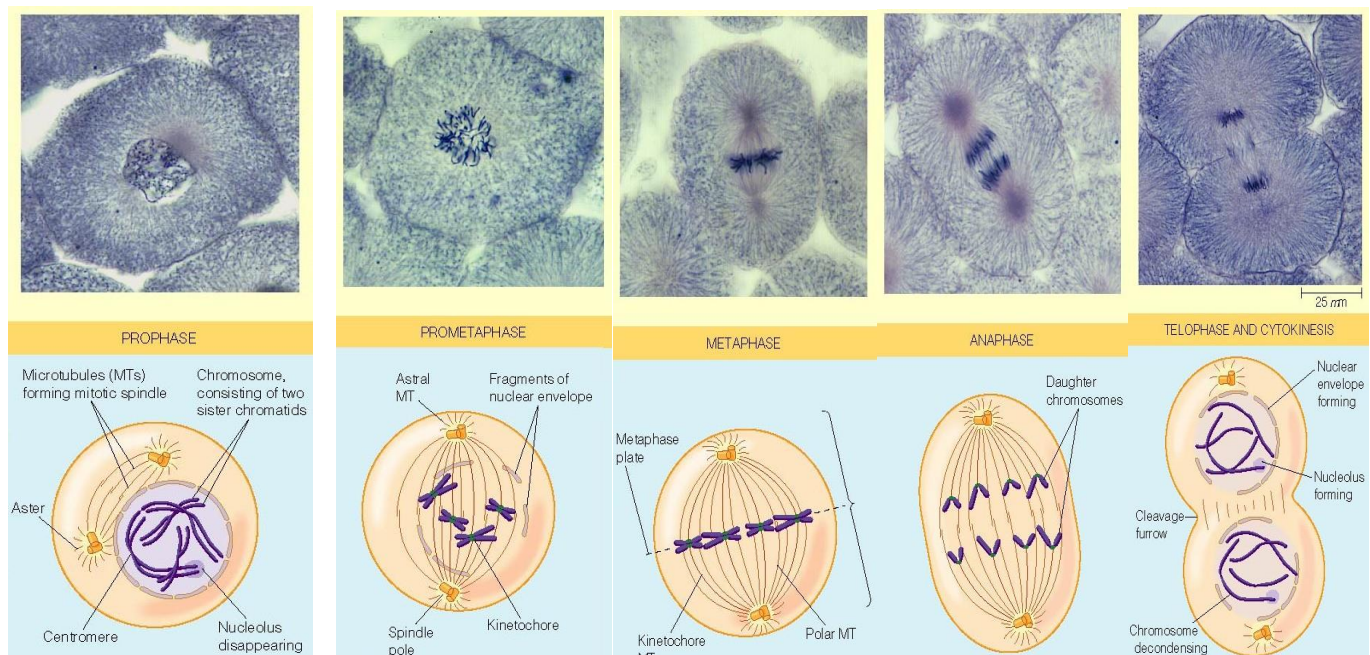
Mitosis

a) Prophase

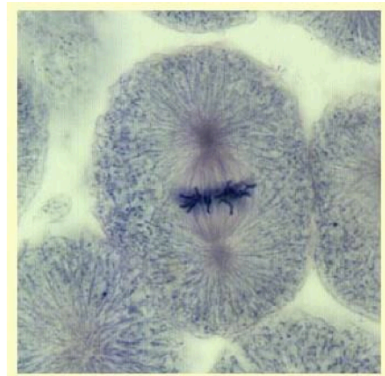


Late prophase (prometaphase)

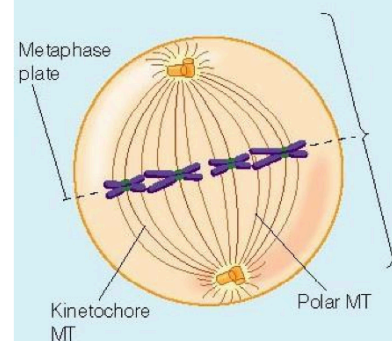
Microtubules radiate out from the centrioles, forming an **aster**. When all these events have taken place, the nuclear envelope breaks up and the microtubules are arranged to form a barrel-shaped structure, called a spindle across the central part of the cell between the centrioles. The microtubules involved in the spindle are referred to as spindle fibres.



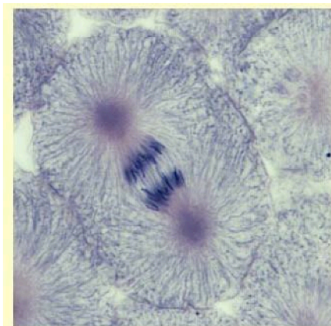
Metaphase



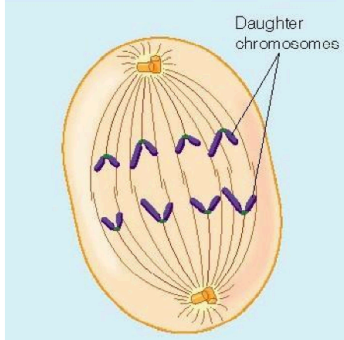
METAPHASE



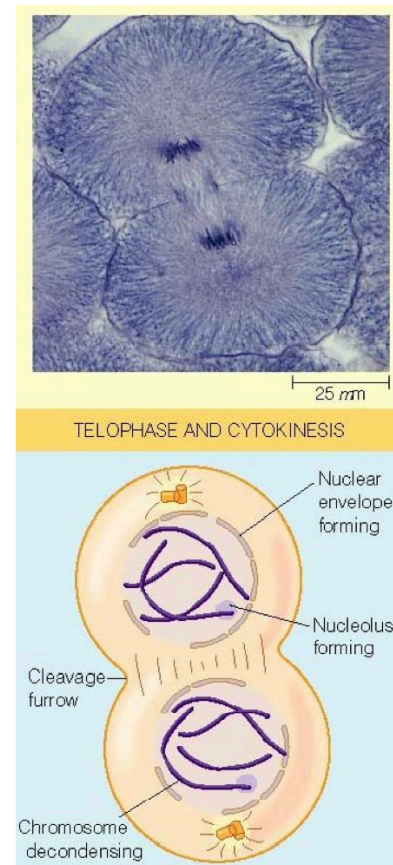
Anaphase



ANAPHASE



Telophase



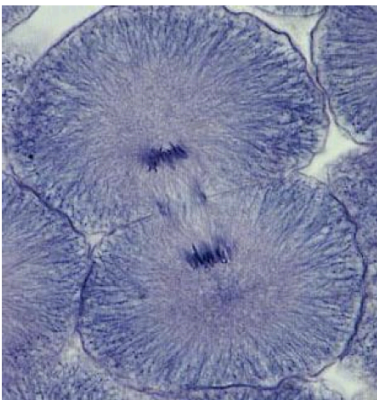
Simple summary of mitosis

- A single cell division of the chromosomes and the nucleus.
- The number of chromosomes remains the same.
- Homologous chromosomes do not associate and no crossing over occurs.
- Daughter cells are identical to parent cells (in the absence of mutations)
- Two daughter cells are produced
- Chromosomes form a single row at the equator of the spindle.

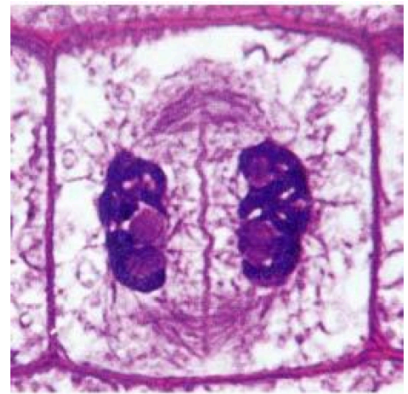
Mitosis is followed by Cytokinesis

This may actually start during late telophase. Use your textbook to summarize the main features of cytokinesis. Make sure you highlight any major differences between this process in plant and animal cells.

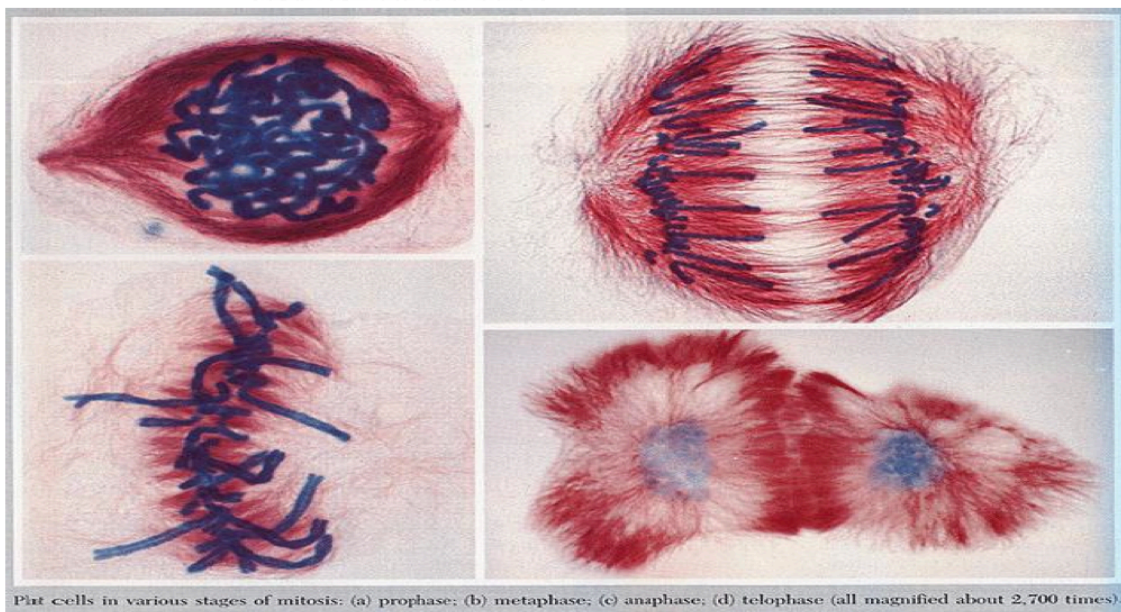
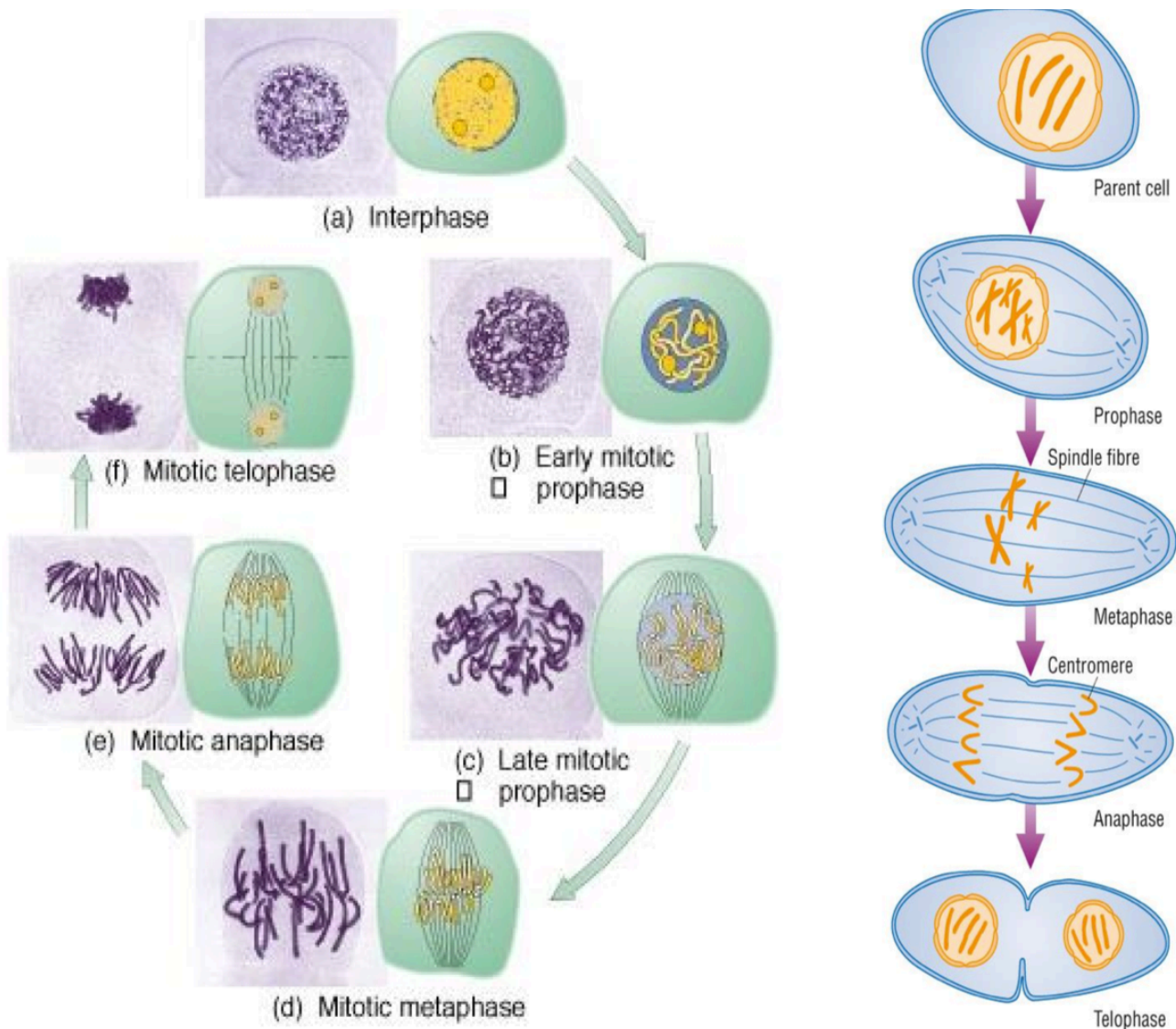
Cytokinesis in animal cells



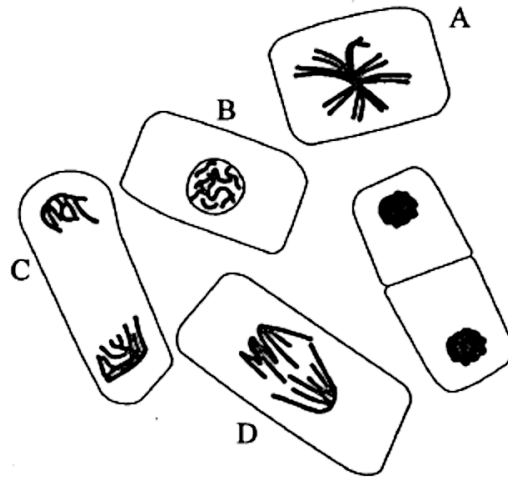
Cytokinesis in plant



An Overview of Mitosis



4. The diagrams below show some cells in different stages of mitosis.



(a) Name the stages of mitosis shown by the cells labelled A, B and C.

A

B

C

(3)

(b) Describe the events that occur in the stage of mitosis shown by cell D.

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(2)

(c) Explain the significance of the stage shown by cell D.

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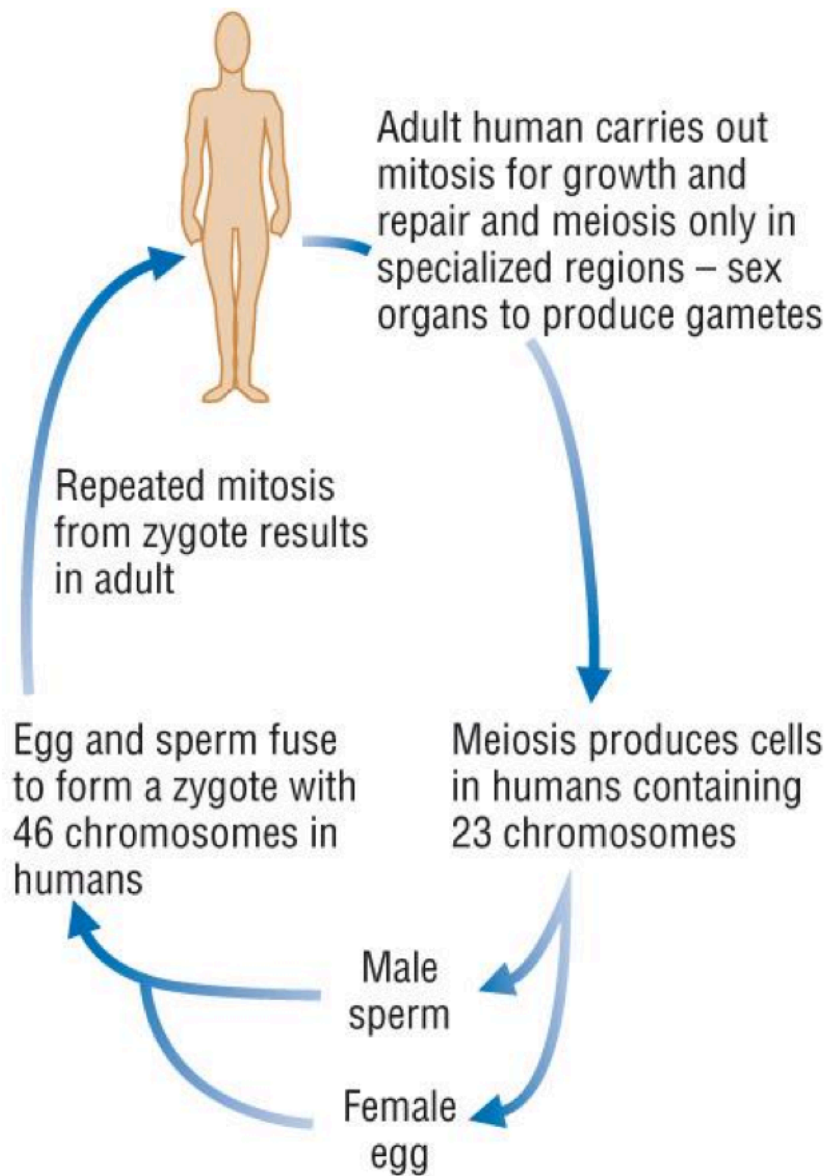
(1)

(Total 6 marks)

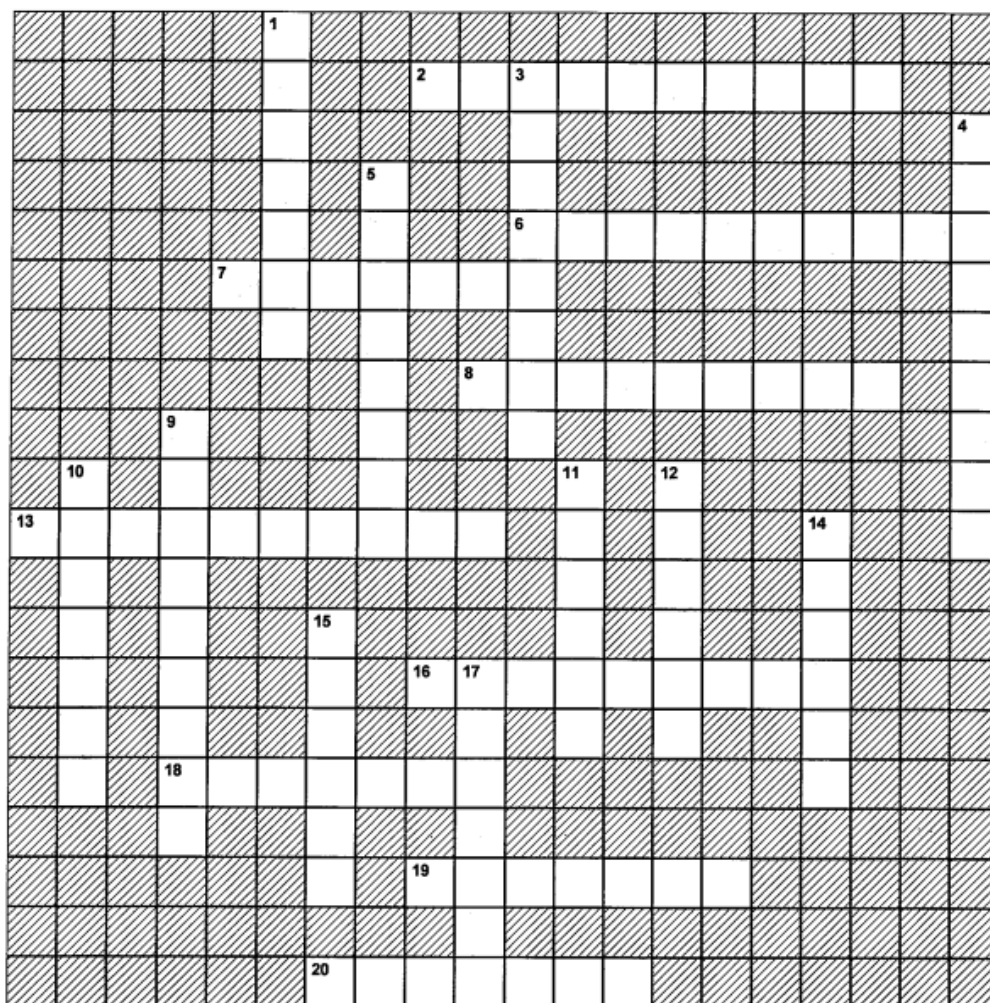
Producing Cells that are genetically different

There is a second type of nuclear division that can occur in a cell cycle. **This is called meiosis and it used to produce gametes.**

Give the main differences between mitosis and meiosis:



Cell Division



ACROSS

- 2** Pairs of chromosomes that are a similar size and shape (10)
- 6** Phase of mitosis at which DNA is replicated (10)
- 7** Cell division, results in a cell with two sets of chromosomes (7)
- 8** Stage of mitosis at which nuclear membranes reform (9)
- 13** This is the point at which two chromatids are joined (10)
- 16** Genetic change as a result of sexual reproduction (9)
- 18** Fibres that move chromosomes around during mitosis (7)
- 19** Animals can be artificially cloned by a process known as _____ transfer (7)
- 20** Cell that has only one set of chromosomes (7)

DOWN

- 1** Cell that contains homologous pairs of chromosomes (7)
- 3** Part of a plant where cells are constantly dividing (8)
- 4** Mitosis gives two cells with _____ genetic material (9)
- 5** During this stage of mitosis chromosomes become visible (8)
- 9** During cytokinesis this divides in two (9)
- 10** Type of cell division that is an important part of sexual reproduction (7)
- 11** Use of cells produced in mitosis (6)
- 12** Diploid cell produced by the fusion of two gametes (6)
- 14** Genetically identical organisms (6)
- 15** Long shoot connecting parent plant and young in vegetative propagation (6)
- 17** Mitosis can be used in this type of reproduction (7)